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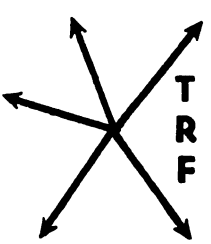

TRANSPORTATION RESEARCH FORUM

Planning Transit Services For Suburban Areas*

*by James W. Schmidt*** and *James P. Curry***

ABSTRACT

MANY SUBURBAN AREAS throughout the United States and Canada are currently being faced with the problems of providing public transportation both to serve as collection-distribution links to corridor mass transit systems and to meet local travel demands as an alternative mode to the automobile. This paper reports a methodology used to explore these questions and some major findings from studies recently carried out in Contra Costa County, California, a suburban area soon to be served by Bay Area Rapid Transit (BART). A majority of the County's employed residents commute to central cities outside the County and nearly two-thirds of the households own two or more private automobiles. Conventional fixed-route, fixed-schedule bus systems will not substitute for private automobile use by the general public and cannot be economically justified for either BART feeder or local service functions. New forms of public transportation are required. When available in conjunction with modern, high-speed corridor service, a public automobile system (PAS) may substitute for large numbers of second and third private automobiles. Additionally, a limited-service dial-a-bus system was determined to be the most cost-effective alternative to complement the BART corridor system for the elderly and other segments of suburban population without access to an automobile.

This paper reviews the evolution of a set of proposals for public transit in Contra Costa County, California. The approach used in analyzing and evaluating alternatives for this area has been subsequently applied to other projects with considerable success in isolating key issues quickly and focusing analytical attention on the most promising alternatives. The principal features will be illustrated using the Contra Costa County analysis as a case study example.

BACKGROUND

Bay Area Rapid Transit (BART) service is scheduled to commence in Fall 1972 with transbay service expected to be in operation by the Summer 1973. BART will provide modern, high speed rail rapid transit linking three San Francisco Bay area counties (see Figure 1)—San Francisco, Alameda, and Contra Costa.

At the present time, most of Contra Costa County and a portion of Ala-

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STUDY AREA LOCATION

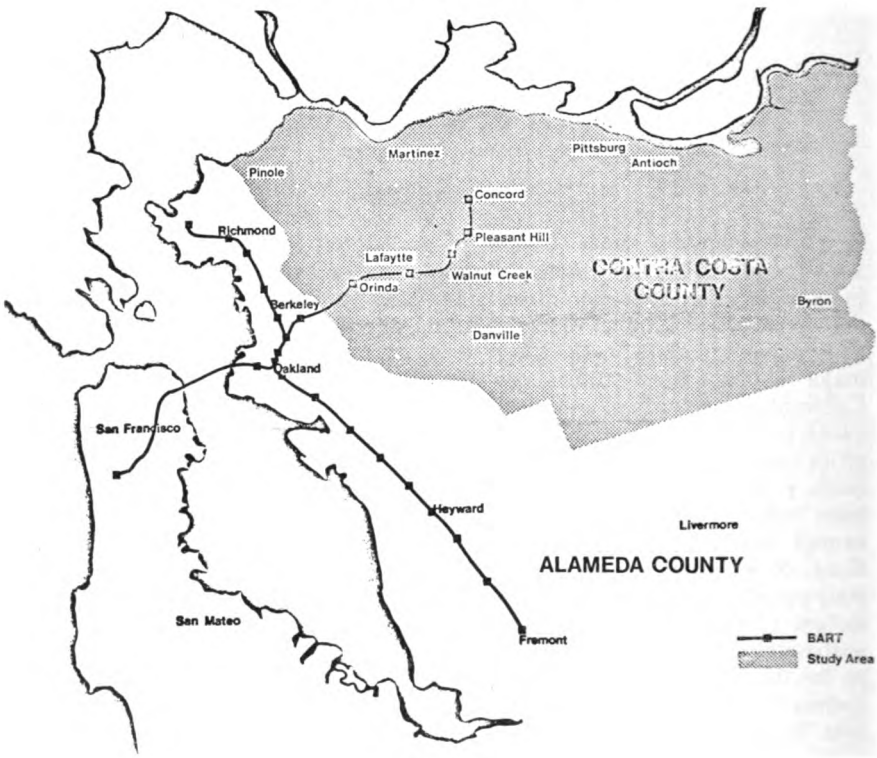

FIGURE 1

meda County have no local public transportation service which might serve the BART feeder function. The San Francisco Municipal Railway (MUNI) currently operates throughout San Francisco County and the Alameda-Contra Costa Transit District (AC Transit) provides local and transbay bus service to most communities in Alameda County as well as a portion of Contra Costa County. Revamping of routing and service schemes is presently being developed by both agencies in anticipation of the introduction of BART service.

In early 1970, the Contra Costa County Transportation Board was created by BART, AC Transit and the County of Contra Costa as a joint powers agency to study the need for public transportation services in that part of Contra Costa County outside the existing AC Transit service area.

The study area is illustrated in Figure 1. The Board contracted with De Leuw, Cather & Company who in association with the Institute of Regional and Urban Studies carried out the study with a twofold objective—to develop a public transportation system that would provide (1) feeder service to and from the BART stations located in the study area, and (2) local service for trips made within the study area.

STUDY AREA CHARACTERISTICS

Contra Costa County has grown rapidly in the post World War II period, increasing from a population of nearly 300,000 in 1950 to a 1970 level of 560,000 persons.

The topography within the County is generally rolling and hilly; development has concentrated in distinct corridors within major valleys and along the water to the north and west. Most of the population increase has occurred in the central section of the County including the cities of Walnut Creek, Concord, and Pleasant Hill. Walnut Creek's population has increased from 2,420 in 1950 to 39,844 in 1970. The population of Concord was 6,953 in 1950, and had increased to 85,164 at the time of the 1970 Census.

The study area is characterized by predominately low density development; typical residential areas have gross population densities ranging between 2,000-8,000 persons per square mile. There is some heavy industrial activity in the Pittsburg-Antioch-Martinez area. Many study area residents commute to jobs in San Francisco and Alameda Counties. The 1965 study by the Bay Area Transportation Study Commission (BATSC) indicated that over 40 per cent of the County's employed residents commuted to work outside the County.

Income levels in the study area are well above Bay Area and national averages. Car ownership rates are correspondingly high. In 1965, almost two-thirds of the study area households owned two or more automobiles. Only three per cent of the households had no automobile. Local bus service is nearly non-existent. Greyhound Lines - West provides inter-county commute service to Oakland and San Francisco, which will be abandoned when BART opens. Greyhound does not circulate into residential areas or feed major activity centers within the County.

METHODOLOGY OVERVIEW

The method of approach in carrying out the study analysis is of particular interest to our discussion. Several concepts are basic to the design of the analysis schema. First, there is general dissatisfaction with conventional approaches which result in inordinate allocation of time and budget resources toward data collection and data manipulation efforts, much of which have dubious consequence or importance regarding final conclusions. It was desired that direct relevance to the final products be demonstrable for each data item and the level of data accuracy or refinement. Secondly, concentration of attention upon specifics of alternative plans from the very beginning of the analysis is considered positive. Early articulation of specific plans helps to clarify analysis requirements and also stimulates greater depth and more penetrating evaluation. The project staff has greater time to pursue analyses and thoroughly think through the evaluation steps, and more directed effort results from focus on plan specifics rather than number gathering, pushing or other abstractions. The third major feature of the analysis approach is of primary importance—and that is the fundamental necessity for a sound evaluation framework. Most transportation planning or analysis involves comparison of alternative courses of action. The key then is to be able to discriminate between the available choices in order to identify which alternatives are most

effective in meeting stated goals and objectives. A corollary element in the planning process is to structure the analysis such that evaluation results are used in the plan development process. All too often this is not the case. A specific plan is developed without interaction and feedback from evaluation of alternatives; the evaluation process is perceived as merely an exercise to justify a particular plan rather than as a useful tool to help optimize the plan specification.

Basic Concepts

The analysis approach conceived in response to the criteria and objectives outlined above has four key elements:

- Development of final results by a series of approximations.
- Consideration of all principal work elements during each cycle in the approximation series.
- Interaction between technicians and decision makers-citizen groups.
- An evaluation framework for choosing among alternatives.

The basic idea is to generate initial results very early in the project by working by approximations. The major work elements can be categorized as 1) preparation of inputs, 2) plan development or specification, 3) plan evaluation and 4) specification of implementation requirements. Each of these major work elements are addressed during each approximation cycle in order to identify critical issues and conclusions which then guide the work specification for the succeeding approximation refinement cycle.

Figure 2 illustrates this analysis approach and contrasts it with the conventional planning process. In the conventional approach the major work elements are carried out in a linear sequence; evaluation results and information regarding implementation requirements often is not available until close to the end of the project. The approximation technique yields preliminary information about all of the principal elements very early; technical staff and policy makers have early identification of critical issues and insight into the viability of various plans or concepts. Further, the requirements for greater data or for greater accuracy in data items can be explicity examined by testing the sensitivity of the important findings and conclusions to changes or errors in the data base; if the results are not sensitive to reasonable changes in the data inputs, there is little need or justification for additional expenditure to refine the data.

Early development of evaluation information is extremely valuable to the plan developers. Evaluation findings can be continually used to refine and improve the quality of the plan delineation and the final products of the study. Information on cost and service quality tradeoffs becomes available to the designers for use in delineation of plans.

The approximation approach has also had positive spinoff value in stimulating early dialogue and involvement between technical staffs and policy makers and the general public. Early results provide opportunity for the planning process to be more adaptive and responsive to policy and citizen

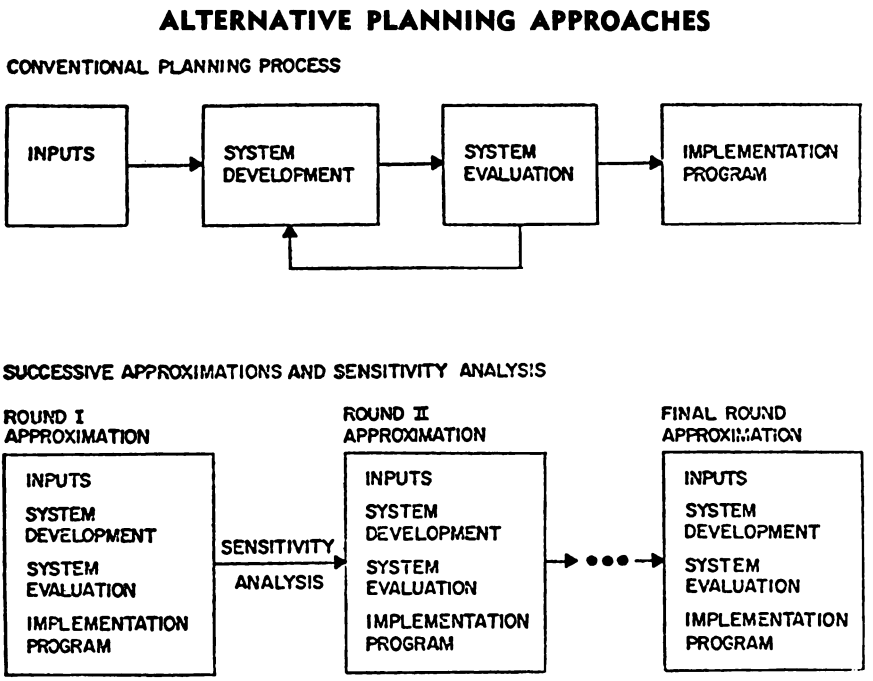

FIGURE 2

groups because it opens up new avenues for communication with relevant information and findings, and more time to accept and adapt to comments and views expressed by these groups. This is not to say that the approximation approach is a panacea. There is a "double-edged sword" danger as well which may arise when preliminary findings run askew of favored positions. Therefore early opposition may also be encountered. But these outcomes are viewed as positive advantages of the approximation planning process because conflicts and issues are surfaced early so that analysis effort, discussion and objective evaluation can be brought to bear upon those critical content issues. This approach is viewed as much preferable over alternative procedures which do not uncover the conflicts sufficiently early to address them in satisfactory depth; and it is unrealistic to assume that the conflicts do not exist simply because the study never identifies and addresses them. Thus, it is a particular merit of the approximation approach that open policy and citizen dialogue can be stimulated in the planning process. The process itself is strengthened by interactions which sharpen the analysis focus and reinforce implementation prospects.

The basis for evaluation is important to the approximation planning methodology. The evaluation approach must be sufficiently comprehensive to deal with the direct or internal impacts of each of the alternative plans as well as the external impacts. When dealing with publicly-funded projects, there should be reasonable evidence that the aggregate public or social bene-

fits are in excess of aggregate public costs. A second important attribute of the evaluation approach is the necessity to provide information on the distribution of the positive and negative impacts (i.e., the incidence of both costs and benefits) upon various groups, sectors, and jurisdictions. This kind of information aids decision makers and the public both in choosing among alternatives and in formulating ideas of how to finance a selected plan. Evidence from many planning exercises over recent years shows that the distributional effects of proposed projects are particularly important and often critical to its acceptance. The evidence suggests that means to achieve reasonable equity between the burdens and benefits of projects across a wide spectrum of societal groups is one of the more challenging aspects of plan formulation to which technicians might profitably address greater attention.

A Case Example

A specific example may be instructive to illustrate the application of the planning approach described above. Figure 3 shows the basic elements of the analysis for the initial approximation cycle in the Contra Costa County Transportation Needs Study. Four concepts of public transit service were specified to complement the BART corridor rapid transit system in the study area. The "No Publicly-Owned Transit" alternative represents the benchmark or base case since it is essentially the "do nothing alternative." Each of the other plan alternatives were structured to represent increasing levels of transit development and sophistication in service quality. The Northern California Transit Demonstration Project Plan, October 1967, (1) refers to recommendations from an earlier study for a limited number of peak-period-only feeder bus routes to the five BART stations in central Contra Costa County. Once the initial plan concepts were developed, specific transit route and service proposals were delineated in keeping with the basic concepts. The data inputs needed to both delineate and evaluate the several alternatives were then identified as shown in Figure 3. Similarly, the content of the evaluation framework was conceptualized and necessary analysis steps were completed to generate the evaluation results.

The analysis work for the first approximation cycle led to initial estimates of total BART ridership from the area and allocation of the riders to the respective stations. Then estimates of feeder bus patronage were made, using rather liberal assumptions about the proportion of BART riders who would use feeder buses to get to and from the BART stations. Estimates of patronage for local trips via transit within the study area were then developed using ridership rates observed in other areas with similar characteristics. The evaluation measures were conceptualized and estimates of costs and benefits were derived.

Sensitivity Analysis

The results of this effort are informative to illustrate a key feature of the approximation approach. The outcome of the initial findings concerning feeder bus service to and from BART stations for peak period commuters, led to a pair of important conclusions. First, the difficulty in providing a feeder bus option to all BART commuters became immediately apparent. Low density development patterns, subdivision layouts with abundant curvilinear and non-continuous streets, hillside development and a multitude of

SUMMARY OF INITIAL APPROXIMATION ANALYSIS

PREPARATION OF INPUTS		SPECIFICATION OF ALTERNATIVES	EVALUATION
• Projection of Employed Residents and Jobs for 9-SFBA Counties • Inter-County Commute Matrix Analysis • Projection of 1980 BART Commuters, 7 - 9 AM • Allocation of 1980 BART Commuters by Station • Distribution of BART Commuters to Zones of Residence • School Busing Analysis	• Activity Centers Mapping • Feeder and Local Mode Split Analysis • Number of 1980 Trips to BART Stations by Zone and Mode • Number of Intra-County 1980 Trips by Zone and Mode • Transit Equipment, Costs and Operating Concepts	• No Publicly-Owned Transit in Contra Costa County • Minimum Transit Service - feeder bus - local bus - school • Northern California Transit Demonstration Project Plan • Extensive Rail/Bus Coordinated Service - feeder bus - local bus - school	• Net System Costs - patronage & revenue - capital cost, equipment requirements, and operating costs • Major System Benefits - traveler - community - school transportation • Financing Alternatives • Community Evaluation

FIGURE 3

other circumstances reduced exposure of commuters to bus service within acceptable walking access distances. The Northern California Demonstration Project (NCTDP) recommended service plan was estimated to provide feeder service within one-quarter mile of about twenty per cent of all BART commuters; further since the NCTDP projected that 19 per cent of BART users would use feeder buses for access and egress to the stations, a very high modal split indeed is implied. When one considers that only one out of every three or four BART trains would have connecting feeder bus service under the recommended headways, it is evident that there is significant discrepancy in the NCTDP estimates.

A second conclusion regarding feeder bus service is perhaps of equal or greater significance. Each of the various service plans were costed to identify both capital and operating expenses on an annualized basis. Based on the ridership projections for the feeder systems, a benefit analysis was completed which sought to identify savings or benefits to residents of the area. Both direct user benefits and community benefits were considered.

In summary, the feeder bus service was shown to generate public savings in three distinct areas:

- direct transportation expenditure savings to users of the feeder service
- secondary savings to some users through gains in income from new or better jobs
- community savings in reduced BART station parking space requirements and congestion costs

The striking findings however was that the cost of rendering feeder bus service far overwhelmed benefits or savings realized. For example, a mini-

mum-scale feeder system would require approximately $1 million per year for operating expenses and debt amortization. In contrast, direct transportation savings were estimated at under $100,000 per year; and indirect income gains (a tenuous category which depends significantly upon economic conditions) plus community savings were valued at about 200,000 per year Thus, annual costs were estimated at over three times the projected user and community benefits.

This conclusion has further significance when examining the data input requirements. To modify the evaluation conclusions, feeder bus patronage would have to be at least three to four times greater than the initial estimates. There is virtually no possibility that the first estimates of ridership could be in error by that magnitude. This kind of sensitivity analysis perspective demonstrated that further data input or modal split refinement effort was unwarranted and that resources would be better utilized in other directions.

CONCLUSIONS REGARDING TRANSIT SERVICE FOR SUBURBAN AREAS

The approximation analysis approach was carried out for a variety of local and feeder transit service alternatives in Contra Costa County. In total, nine different conventional fixed-route, fixed-schedule bus schemes were examined. The evaluation results consistently pointed to a single conclusion: conventional bus systems in suburban settings characterized by high family incomes, the majority of households owning more than one car, and low density, dispersed development patterns cannot generate sufficient savings or benefits to offset their costs. But behind this general conclusion there are a number of findings which should have significance for and application to many other areas.

Accessibility to Transit Difficult to Achieve

In order for public transportation to be of value to residents of an area, the routes and service must be conveniently accessible. Evidence from many communities shows that most bus patrons travel less than three blocks to reach the bus. Densities between 2,000 and 8,000 persons per square mile are common in suburban portions of even large metropolitan regions. At these densities, bus routes spaced at close intervals on major arterial streets do not reach many residences.

Typical suburban development patterns present additional difficulty in rendering conventional transit service. Curvilinear and non-continuous streets, cul-de-sacs and hillside residential development impede effective service by public transportation. Thus, even with an extensive system of local bus routes, a high share of the residents are beyond acceptable distances from the bus routes.

Conventional Bus Systems in Suburban Areas not Competitive with Autos

Because of dispersed, low-density land use patterns and multiplicity of origin-destination trip combinations, conventional bus systems in suburban settings will not be widely used. Even as feeder systems to rapid transit

lines, bus schedule limitations on the choice of trip times, relatively long access times or distance, and waiting times for bus service will preclude effective reduction in the use of the private automobile. Private automobiles will be the dominant feeder made to corridor public transit systems in suburbia.

Only a very small percentage of residents who could reach the bus system would use it. The performance and cost savings to the individual—even at very modest 25-cent fares—would not be sufficient to induce large numbers to switch from private automobiles. The largest bus system tested for central Contra Costa County would attract only 23% of 1980 peak-period BART commuters. Only one or two percent of the 1980 local trips within the central county were projected to be made via transit on the largest conventional bus systems. High car ownership levels and dispersed patterns of origin and destination travel severely limit transit usage. Transit's inability to meet automobile competition in terms of accessibility, flexbility, cost and times are the principal reasons that public transportation in suburban areas cannot capture a significant share of total travel.

Economic Analysis of Conventional Bus Systems not Favorable in Suburbia

The analysis of feeder and local transit service in central Contra Costa County found that capital and operating costs would be substantially greater than user and community benefits. Costs for a feeder system alone would exceed identifiable user and community benefits by a factor of at least three.

Benefits to the community at large through reduced requirement for parking space, less traffic disruption in neighborhoods and reduced congestion on the street network could be compelling reasons to support implementation of public transportation service. However, for these benefits to be realized, there must be measurable substitution of travel from private automobiles to the bus system. The low patronage for a conventional bus system in suburban areas is not likely to yield significant impact on parking, noise, traffic, congestion, and air pollution. With only a few percent of all trips using a bus system, it is clear that community benefits would be minor.

On purely economic grounds, conventional bus systems must be regarded as a poor public investment in a suburban area since costs are well in excess of savings to the public. If public transportation is to be rendered on social criteria apart from economic considerations, it can be demonstrated that alternative forms of transportation are more cost-effective than conventional bus systems.

Distinguish Feeder - Local System Evaluation from Corridor System Evaluation

Analysis of the transit collection-distribution problem as a distinct entity has been very limited. Most analyses have focused on corridor systems. Typically, feeder and local transit service have been evaluated in conjunction with the corridor elements without explicit independent consideration of the feeder-local transit component on its own merits. Consequently, the feeder system frequently has been rationalized on the merits of the corridor system.

This treatment has clearly masked the real feeder issues and proper evaluation basis, particularly in suburban areas. The Contra Costa County feeder and local transit evaluations demonstrate 1) patronage on suburban segments of the corridor system does not depend significantly on the existence of a feeder system and 2) private automobiles will perform most of the feeder function in suburban areas. If inroads are to be made on the use of private automobiles and the negative external impacts of private automobile-dominant transportation systems, new forms of public transportation are needed to complement corridor systems such as BART.

Distinguish the General Public and Limited Mobility Groups

In evaluating alternative feeder and local transit systems it became apparent that two groups must be differentiated for rational analysis—1) persons and households who have access to automobiles as a transportation alternative and 2) persons with limited mobility who do not own or cannot operate private automobiles. Clearly, in suburban areas the "general public" falls in the first category; the elderly, the poor, the handicapped, the young, and non-drivers compose the primary "limited mobility" group. In Contra Costa County 97% of all households own at least one automobile and over two-thirds of the households own two or more private automobiles. While these statistics are higher than for the nation as a whole, the pattern of higher levels of car ownership in suburban areas is common to most metropolitan suburbs. The population composition in central cities is decidedly different with the limited mobility group representing a much larger share of the total population.

The combination of greater mobility and transportation alternatives for the general public in suburban areas means also that public transportation, to be effective, must be capable of competing with the private automobile for trips made by the general public. Limited mobility groups, by definition, have fewer transportation alternatives and are, therefore, more dependent upon public transit. Moreover, their residence locations, trip behavior, and transportation needs are distinct from those of the general public and demand special analyses. Most elderly persons do not make work trips; young people are typically in school until mid-afternoon and the origin-destination foci of their trips do not necessarily coincide with those of the general public; persons with second or third call on family automobiles are normally pre-empted only during certain hours of the day.

Finally, public transportation will have to attract the general public in order to have any significant impact on highway traffic and congestion in suburban areas. To do that, transit must be more competitive with private automobiles—in terms of convenience, accessibility, flexibility, and cost. Without shifts by the general public, transit in suburban areas will not reduce the dominance of the private automobile.

PROPOSED SUBURBAN TRANSIT SYSTEM—AN EXAMPLE

The analyses and conclusions outlined in the preceding section led to specific consideration of a three-part transportation system for the Contra Costa County study area which appeared to be more responsive to travel requirements and characteristics of suburban residents. The three-part system consists of:

1. *Corridor System.* BART is the beginning of the public transportation corridor system. The corridor system should be extended initially using buses as an extension of the BART system to outlying communities. The corridor system would be used for inter-county trips (mainly work trips) as well as long distance intra-county journeys.

2. *Public Automobile System (PAS).* This would complement the corridor system for the general public as well as meeting many local trip needs. A fleet of small, publicly-owned, electric-powered automobiles with modest performance standards would be distributed throughout the central and north County at neighborhood curbstands and major activity centers. They would be suitable for short (1-5 miles) local trips including BART feeder trips. Each vehicle would be used by several drivers every day. Recent research on this system concept has been carried out at the University of Pennsylvania[2,3], Stanford Research Institute[4], and abroad.

3. *Dial-a-Bus System.* Just as the PAS complements the corridor system for the general public, the dial-a-bus system complements it for limited mobility groups who do not have access to or cannot drive an automobile.

The Corridor - PAS system appears to offer a degree of flexibility, scheduling convenience, and journey speed competitive with the private automobile for the general public. The technology needed to make the public automobile system component operational requires research and demonstration; however, it should be implementable in the study area by the 1980's. Analysis of travel characteristics and trip patterns point to this system as an attractive substitute for the second and/or third family automobile. This high degree of substitution potential and corresponding implications for more efficient vehicle utilization, in turn, would generate significant economic gains from reduced multiple automobile ownership for many households. The combination corridor and public automobile system should yield important economic savings to users from lower travel costs and vehicle ownership costs, and to the general public in reduced land requirements for parking, reduced congestion, and lower noise and air pollution levels.[5]

Rationale for determining transportation services to meet the identified special needs of persons with limited mobility centered around the cost effectiveness of various alternatives in satisfying these needs. From the analysis of conventional bus system options, it was clear that those persons living in suburban areas without automobile accessibility must limit travel to trips made with friends, or by taxi, or to destinations within walking distance. The travel and social benefits derived by providing public transportation for these persons are high and outweigh associated costs; however, these costs must be borne to a high degree by the public in general and not by system users. Recognition of this "welfare" situation led to the following analysis.

Cost Effectiveness Evaluation of Alternative Systems for Limited Mobility Persons

Three options were considered to meet travel requirements for limited

mobility groups—subsidized taxi service, limited fixed-route, fixed-schedule bus service, and demand actuated "dial-a-bus." Two criteria were adopted to evaluate the relative effectiveness of the three alternatives:

- Proportion of limited mobility persons served.
- Cost per trip for persons with limited mobility.

Table I summarizes the evaluation of each alternative.

Subsidized taxi operations in Contra Costa County would provide door-step public transportation for the County's limited mobility groups. However, this alternative would be more costly than the dial-a-bus system and present a number of organizational and management problems which render it an unworkable option except for supplemental and emergency standby purposes.

Limited conventional bus service—one hour headways between 9:00 a.m. and 5:00 p.m.—would be the least-cost alternative in terms of cost per user. However, a significant portion of the daily travel demand would not be accommodated by bus service. For comparative purposes, assume that an unserved 800 daily trips were made by taxi at an average cost per trip of $2.00; the average cost of all trips would become $1.40. Hence, when the limited service coverage of the conventional bus option is considered jointly with the cost per user criteria, a different overall evaluation is determined.

Limited dial-a-bus service operating from 9:00 a.m. to 5:00 p.m. in a

SUMMARY OF COST EFFECTIVENESS EVALUATION

Alternative	Annual Cost (a) ($ Millions)	Average Daily Passengers	Effectiveness Criteria: Cost Per Trip	Effectiveness Criteria: Per Cent of Limited Mobility Population Served
Subsidized Taxi Service	?	?	More than $1.30	100
Limited Bus Service on one hour Headways	0.7	2,200	$1.18	73
Limited Dial-a-bus	1.1	3,000	$1.30	100

(a) Includes annual operating and capital debt retirement cost.

TABLE 1

many-to-few mode with manual dispatching proved to be the most cost-effective alternative. It provides accessibility to major activity centers for shopping, medical, social-recreational, and other purposes for all limited mobility persons in the study area. From computer simulation tests based on operating parameters from actual operating systems, many-to-few service with manual dispatching, average riding times of 10-15 minutes, and average waiting times of 30-45 minutes was estimated at an average cost per ride of approximately $1.30. In addition, the doorstep service afforded by dial-a-bus would eliminate for the elderly and handicapped much of the physical difficulty and discomfort associated with fixed route conventional bus service.

SUMMARY AND OVERVIEW

The paper has reviewed how the feasibility and advisability of providing public transportation service to serve both a feeder function for a high-speed modern rail transit system and a local transportation function in a suburban area has been analyzed in one case. While some conclusions and proposals are necessarily area-specific, many aspects of the study approach and findings have application in other areas and to other problems.

Current development and emphasis on sketch planning techniques fit well within the overall methodology of successive approximations and sensitivity analysis. This approach can be well applied to a variety of transportation and land use planning questions to screen and subsequently narrow the range of feasible alternatives, and focus on key issues requiring detailed review and evaluations.

It was concluded that conventional fixed route, fixed schedule bus service could not be justified for feeder and local transportation functions in the suburban setting studied. This type of transit service would not significantly reduce the dominance of the private automobile for either feeder or local trip purposes. User and community benefits would fall far short of even matching systems costs. If public transportation is to have any significant impact on the use of private automobiles in suburban areas, it must become more competitive in terms of flexibility, accessibility, convenience, and cost. A public automobile system (PAS) to complement corridor rapid transit and serve short distance (1-5 miles) local trips was proposed for further research and demonstration in Contra Costa County as a step towards effectively reducing reliance on private automobiles. Analysis of PAS pointed to potential substitution for multiple car ownership for many families generating substantial economic benefits for both users and the community in general.

The automobile dominance and dispersed land development patterns characteristic of suburban areas have accentuated mobility problems for a subset of the suburban population who do not have access to an automobile and must rely on taxis or friends to make trips longer than walking distance. This group includes the elderly, the handicapped, the young, the non-drivers, and persons from low income households. The travel needs of these groups are much different than those of the general public and competition with automobile usage is not an issue. The cost of providing public transportation service for these persons will be largely covered by the public in general, and not by users.

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